

Green Development: Good for Water and the Bottom Line

Design, Construction &
Long-Term Sustainability

Water Management
and Efficiency in Green
and High Performance
Buildings

“Water is the supreme sculptor of
our environment”

- Craig Campbell

*Water in Landscape
Architecture*



New Civic Works



Hillary Brown, FAIA LEED AP Principal

overview

- green development principles
- guiding concepts for water management
- water efficiency practices for buildings & sites
- case study:
 - The Queens Botanical Garden's new Visitor Center: *reflections on water*

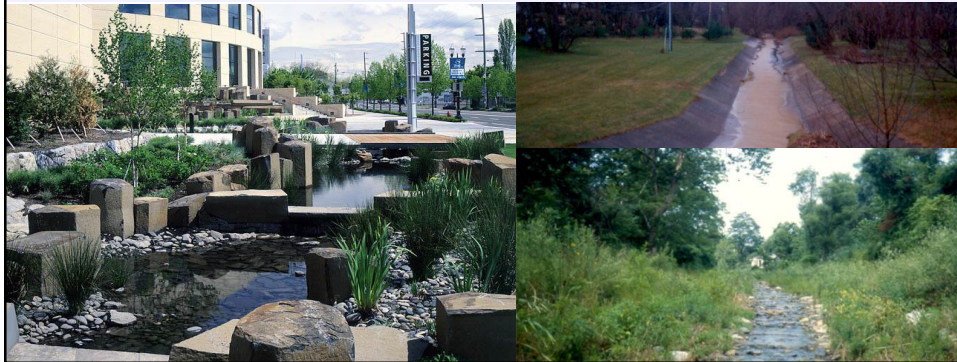


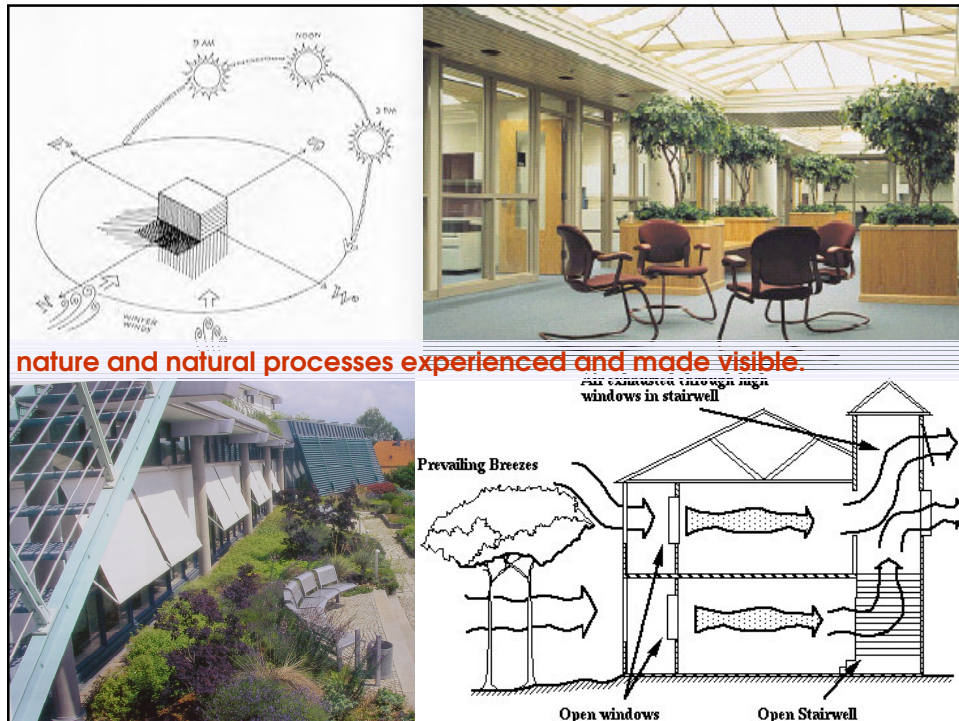


... solutions grown from place-based thinking



constructed systems designed to behave like natural systems they've replaced





Prereq 1	Minimum IAQ Performance	
Prereq 2	Environmental Tobacco Smoke (ETS) Control	
Credit 1	Carbon Dioxide (CO ₂) Monitoring	
Credit 2	Ventilation Effectiveness	
Credit 3.1	Construction IAQ Management Plan, During Construction	
Credit 3.2	Construction IAQ Management Plan, Before Occupancy	
Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	
Credit 4.2	Low-Emitting Materials, Paints	
Credit 4.3	Low-Emitting Materials, Carpet	
Credit 4.4	Low-Emitting Materials, Composite Wood & Agrifiber	
Credit 5	Indoor Chemical & Pollutant Source Control	
Credit 6.1	Controllability of Systems, Perimeter	
Credit 6.2	Controllability of Systems, Non-Perimeter	
Credit 7.1	Thermal Comfort, Comply with ASHRAE 55-1992	
Credit 7.2	Thermal Comfort, Permanent Monitoring System	
Credit 8.1	Daylight & Views, Daylight 75% of Spaces	
Credit 8.2	Daylight & Views, Views for 90% of Spaces	

Potential Savings (per square foot)	
FINANCIAL BENEFITS for the CITY BUDGET	
ENERGY budget (30% savings)	\$ 0.20 to \$1.50
WATER budget (10% savings)	\$ 0.025 to 0.050
OPERATIONS & MAINTENANCE budget (25% savings)	\$ 0.11 to 0.77
PERSONNEL budget (1% increase in productivity)	\$ 2.00 to 5.00
(1 fewer sick day per year)	\$ 0.25 to 0.55

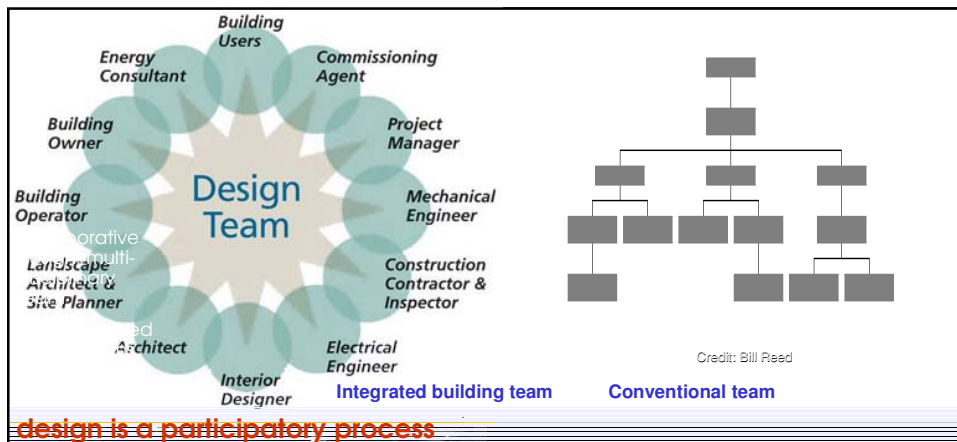
* based on findings from other high performance buildings

Operating energy savings at 33% greater than code compliant building --\$94,000 annual savings

Ecological accounting informs design

44% reductions in carbon dioxide emissions

- 30% potable water use reduction
- Avoidance of landscape irrigation
- Systems free of CFC's & HCFC's (ozone depleting refrigerants)
- 10% renewable energy contribution
- Steel produced with 88% post-consumer recycled content

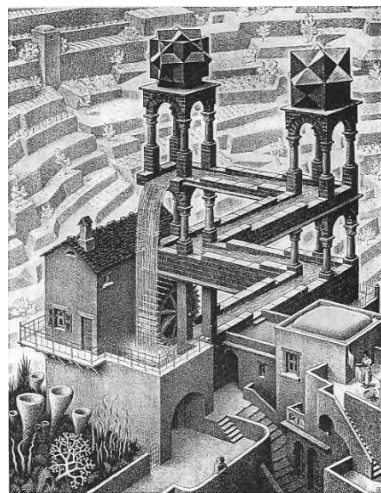


design is a participatory process



- Allows for "buy-in" to solutions
- Education process is accelerated
- Decisions are verified
- Adversity is diminished
- Nuances of organizational issues are learned
- Design process is expedited

a consumer's view of the water cycle



M.C. Escher, Waterfall, 1961

today's principles for human consumption of water

- ecological integrity protects water quality/quantity
- efficiency isn't enough: we need to create restorative or regenerative systems
- "Let water go its own way, giving it gentle guidance"
- "Hydrologic cycle should be the organizing system for all human use of water"

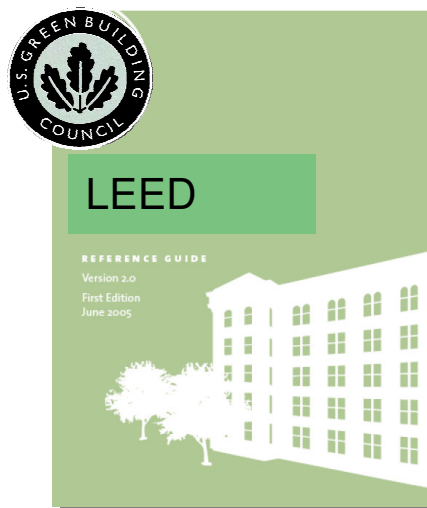


water efficiency practices for buildings and site

LEED® Green Building Rating System

Sustainable Sites Credits

- stormwater management – Quantity control
- stormwater management – Quality control

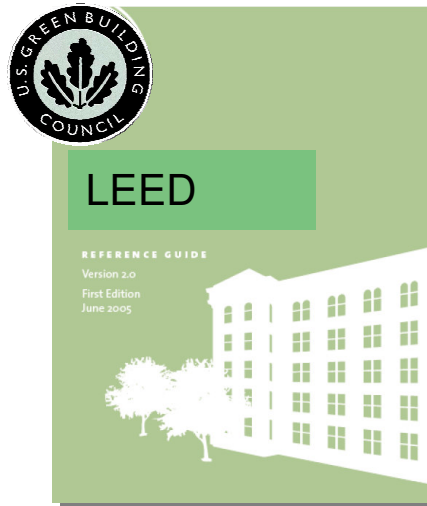


water efficiency practices for buildings and site

LEED® Green Building Rating System

Water Efficiency Credits

- water-efficient landscaping
- building water use reduction
- innovative technology

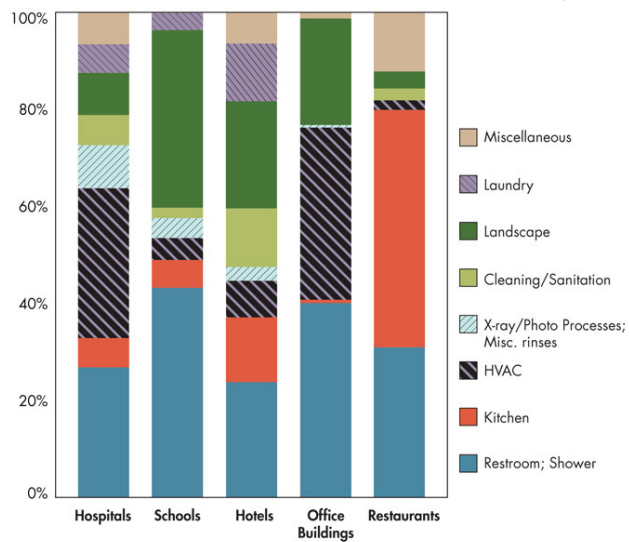


water consumption profiles

End Use of Water in Commercial Buildings

Consumption varies by:

- Building type

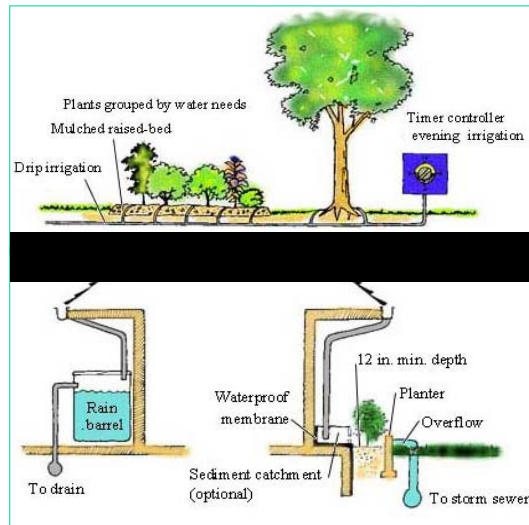


Source: AWWA Research Foundation
copyright: Building Green

Create water efficient landscaping, reducing potable water use

- Eliminate permanent irrigation systems
- Consider high-efficiency irrigation systems
- Collect and use rainwater or gray water for landscape irrigation, urban gardening

LEED WE Credits 1.1, 1.2



water efficient landscaping strategies

- Use drought tolerant, adapted species
- Use drip irrigation or soaker hoses.

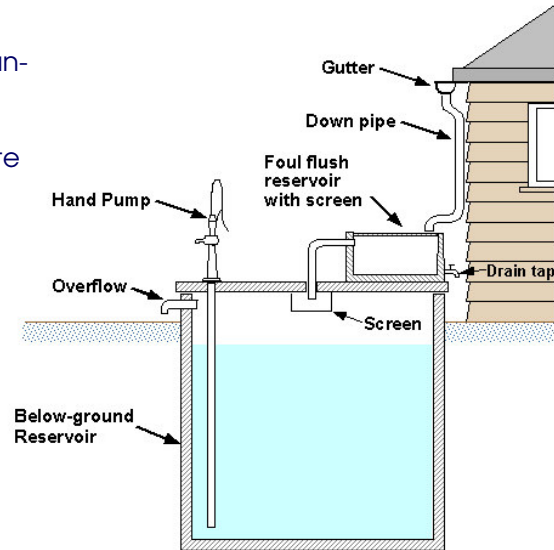


Photo: Denver Water



water efficient landscaping strategies

- Collect rooftop run-off for landscape irrigation, urban gardening and site washing



water efficient landscaping strategies

- Disconnecting stormleaders
- Create raingardens



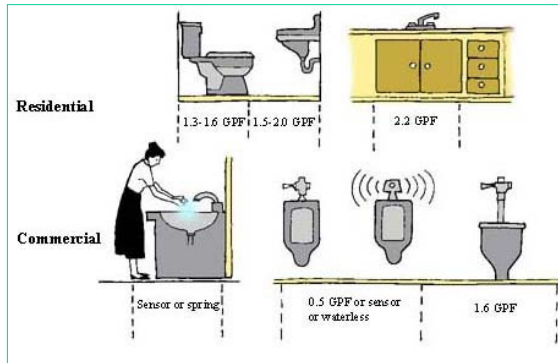
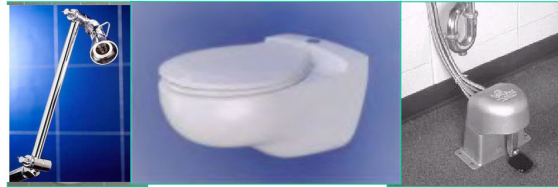
Rain Garden



Potable water use reduction through efficiency strategies



- Use high-efficiency, reduced flow, or dry fixtures/fittings:
 - Low-flow
 - Waterless
 - vacuum
- Consider electronic sensors on lavs
- Install foot pedals to operate lavatory at washing and dishwashing areas



LEED WE Credits 3.1, 3.2

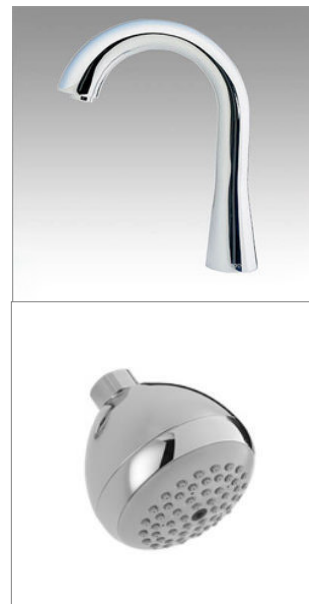
water use reduction

Plumbing fittings

- Low-flow
- Sensor operated
- hydro-powered turbine recharges electric eye

Conventional lavatory	2.5
Low Flow lavatory	1.8
Ultra low flow	.5
Kitchen sink	1.8

Conventional shower	2.5
Low flow shower	1.8



water use reduction

Retrofit plumbing fittings

- Faucet and shower aerators
- Sensors and shut-offs
- Conventional urinal can reduce flushing with Eco Blue Cube



water use reduction

Fixtures and fittings

Toilets (current = 1.6 GPF)

(older fixtures= 3+)

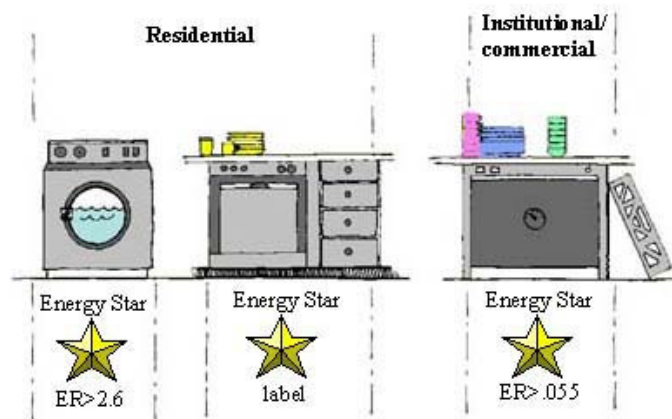
- Low-flow 1.1
- Dual-flush .8 – 1.6
- Pressure assist .8
- Flushometer 1.3



water use reduction

Water efficient appliances

- horizontal axis clothes washers.
- dishwashing equipment that recycles rinse water.



water use reduction

Consider 'tankless waterheaters'

- Deliver heat at the source

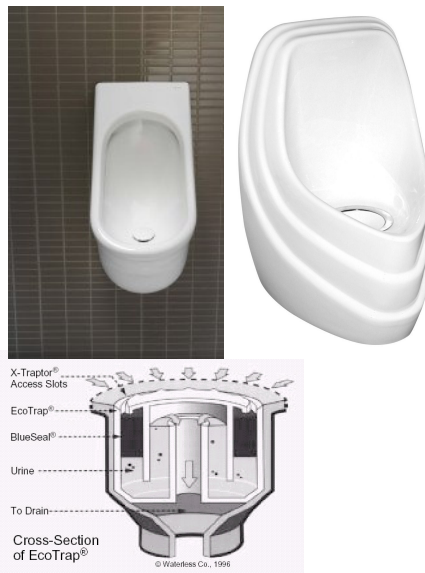


innovative wastewater technology

Use dry fixtures

Urinals

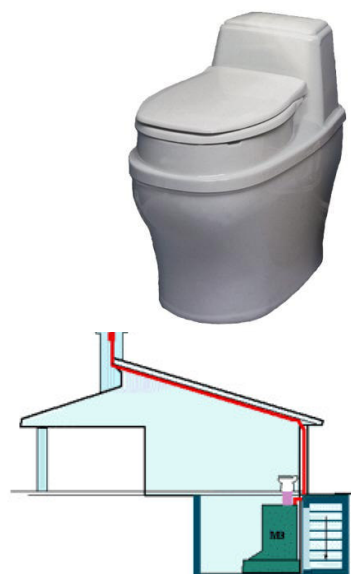
- Low-water use
- Waterless



innovative wastewater technology

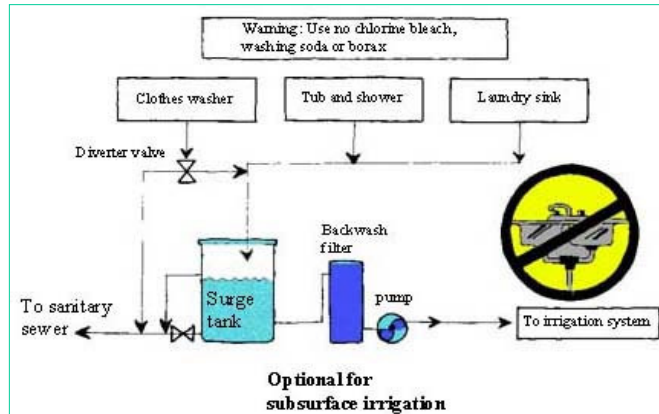
Use dry fixtures

- Composting toilets



innovative wastewater technology

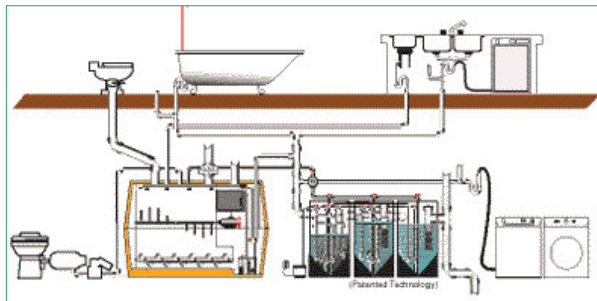
- Reduce potable water use by substituting greywater or stormwater for toilet flushing



LEED WE Credits 2.1, 2.2

innovative wastewater technology

- Treat wastewater on site for non-potable building or site reuse
 - Packaged biological nutrient removal system
 - constructed wetlands



LEED WE Credits 2.1, 2.2

innovative wastewater technology

Treat water on site to tertiary standards

- 'living machine' or constructed wetlands



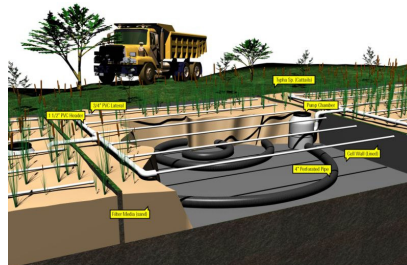
LEED WE Credits 2.1, 2.2



innovative wastewater technology

Treat water on site to tertiary standards

- Provide constructed wetlands



Rose Acre Farms

LEED WE Credits 2.1, 2.2

other efficiency measures

- Reduce/ eliminate potable water for non-potable process use in building system equipment
 - Cooling towers
 - Vacuum pumps
 - Air compressors
 - Mechanical seals on pumps
- Capture air handling system condensate for non-potable applications



current trends

- EPA 2006 WaterSense
 - 130 HETs
- Alternative water sources –non-potable
- Behavioral change



Water Management and Efficiency in Green and High Performance Buildings

CASE STUDY:

Queens Botanical Garden Visitors' Center

Flushing, NY

Funded: City of New York
Department of Cultural Affairs



Context

City of New York

Department of Design
and Construction

1999 "High Performance
Building Guidelines"

2005 "High Performance
Infrastructure
Guidelines"

2006 Local Law 86 (green
buildings)

2007 PlaNYC 2030

2008 City Council Intro # 670



Summary Accomplishments

LEED Platinum

16,000 s.f.

Features include:

- Water efficiency 81%
- Energy cost savings 39%
- Geothermal heating and cooling
- Integrated PV rooftop panels (20% of electrical needs)
- 90%+ CD waste recycled
- 20%+ regional materials
- FSC wood

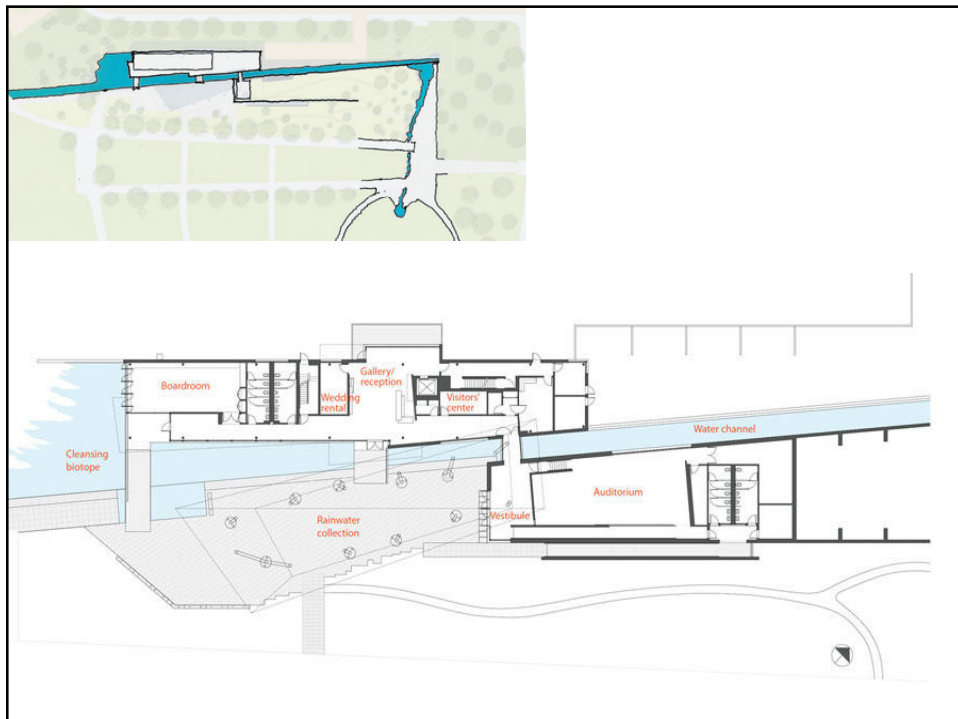
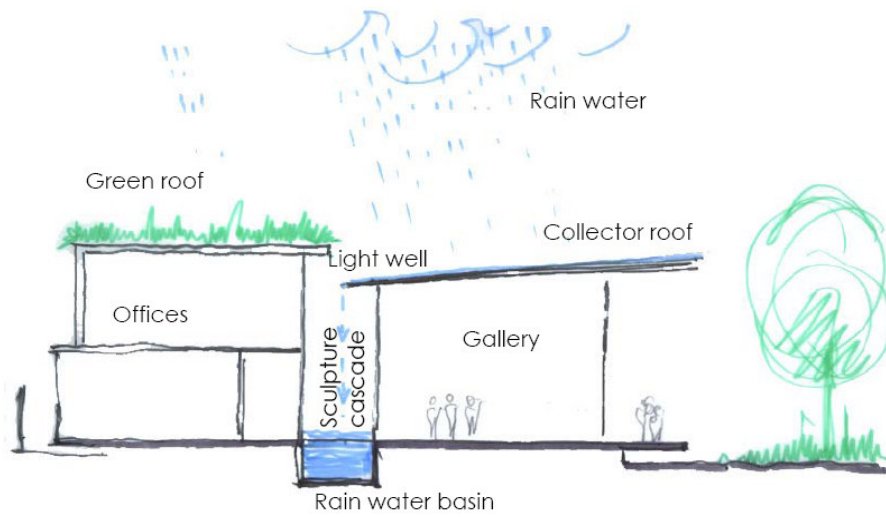


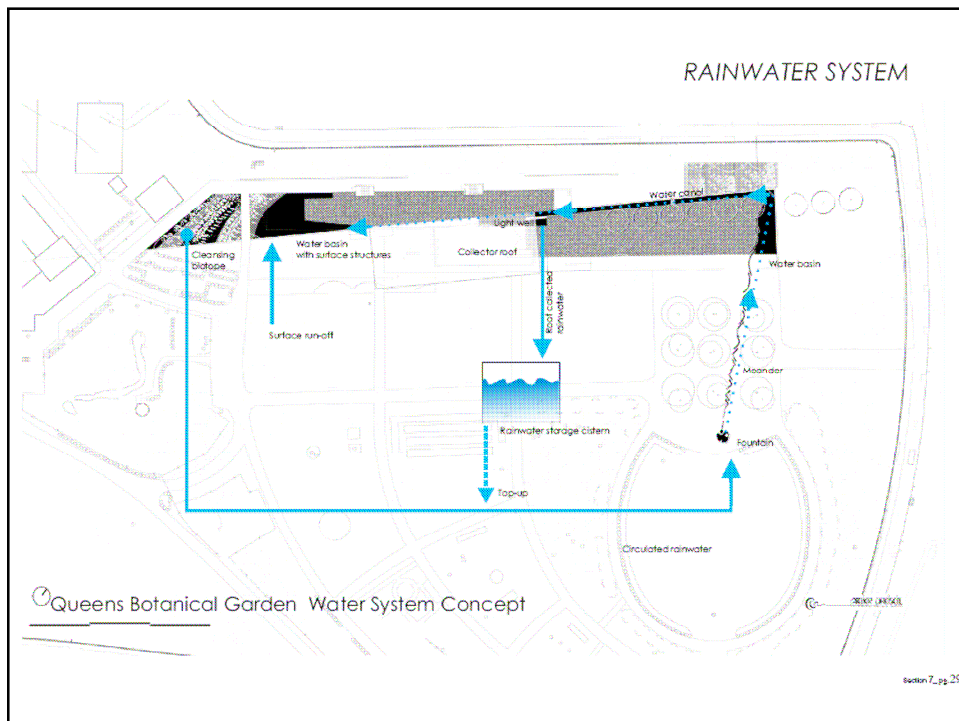
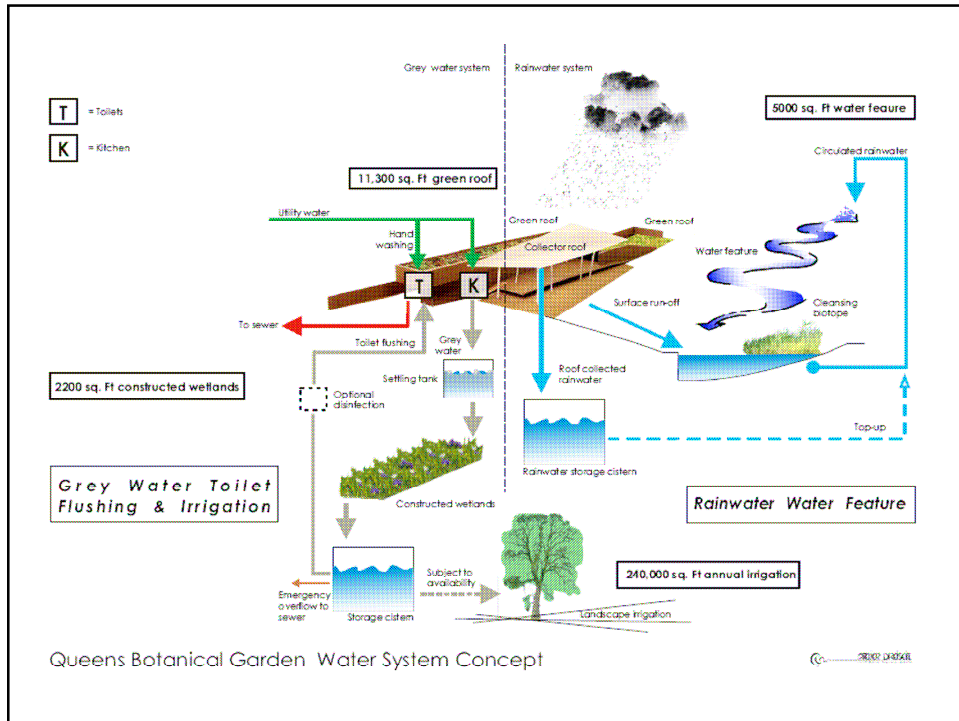
Context

- ethnic diversity
- mission of botanical garden
- water as unifying theme



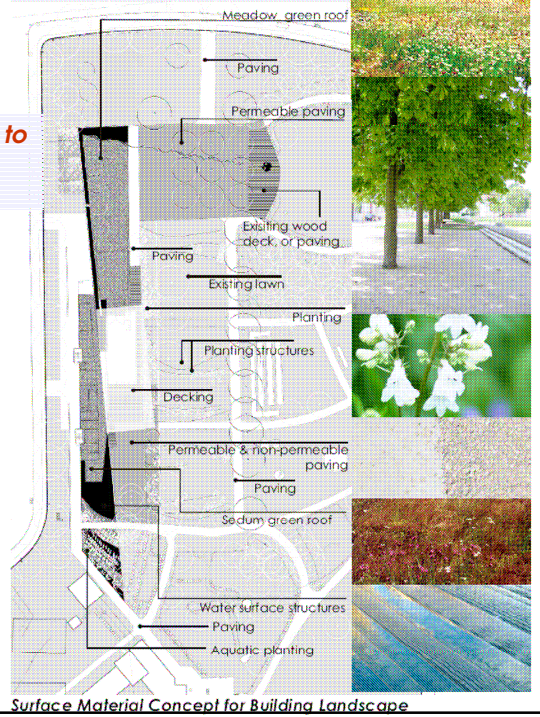
*.....nature and natural processes
experienced and made visible.*



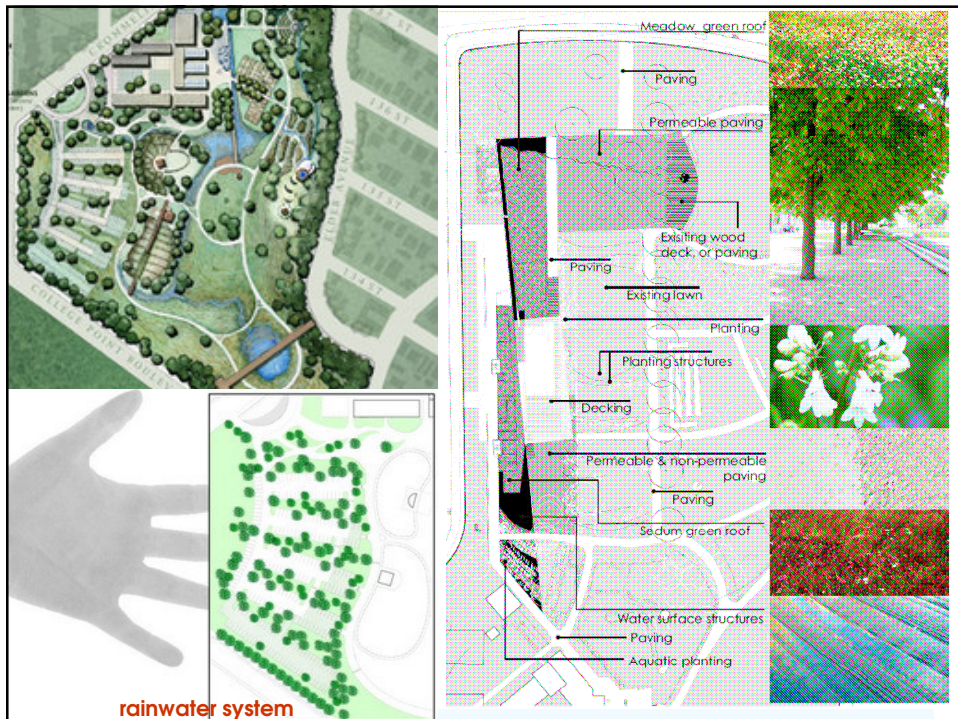


...constructed systems designed to behave like natural systems they've replaced.

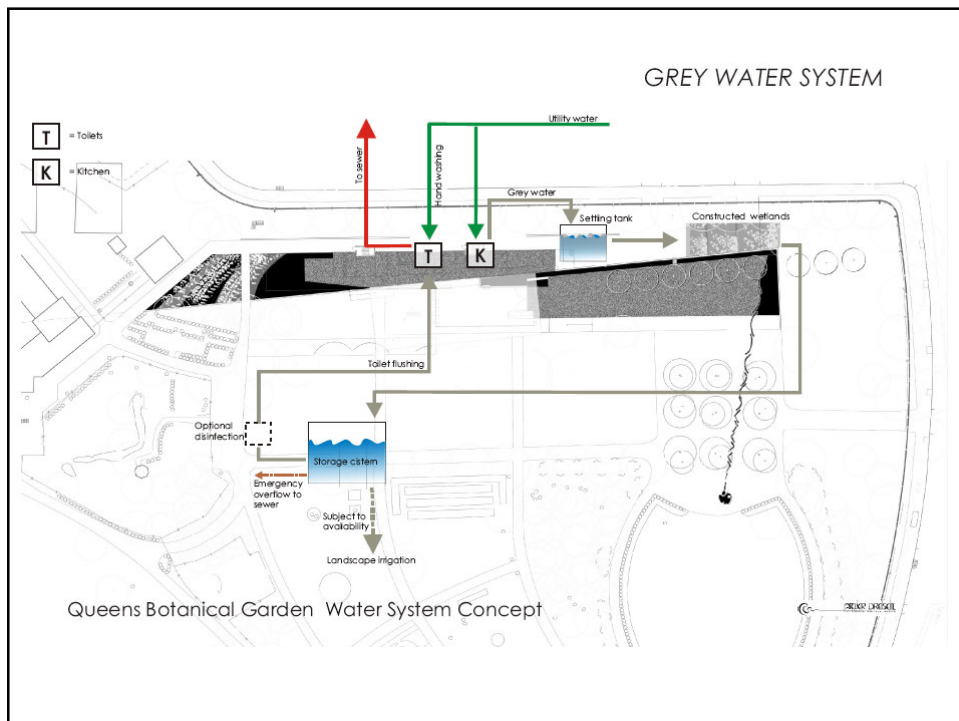
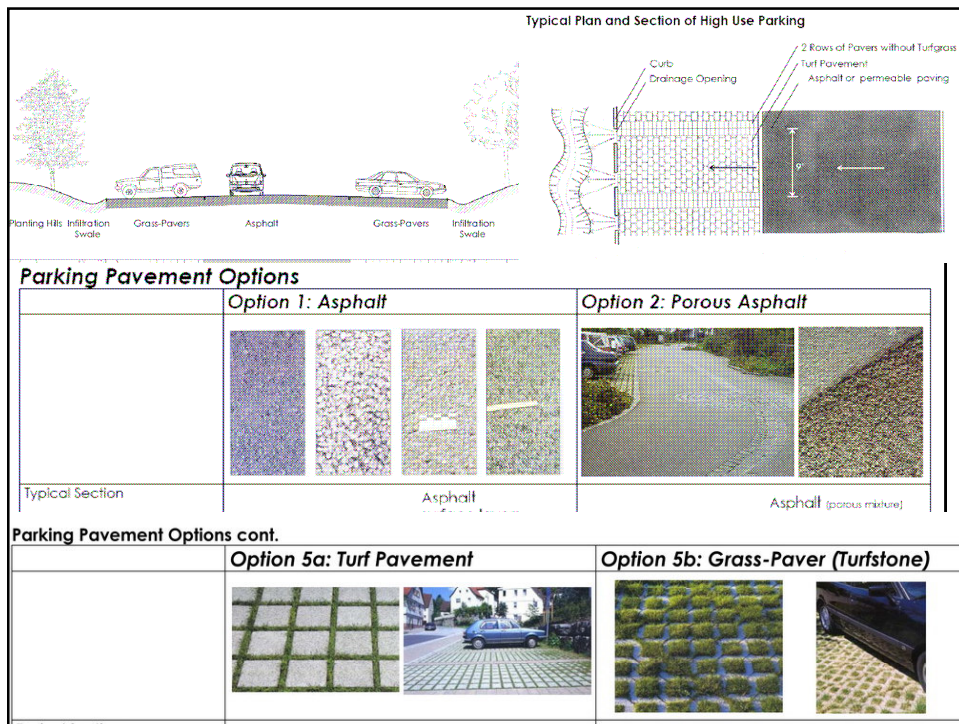
rainwater system



Surface Material Concept for Building Landscape



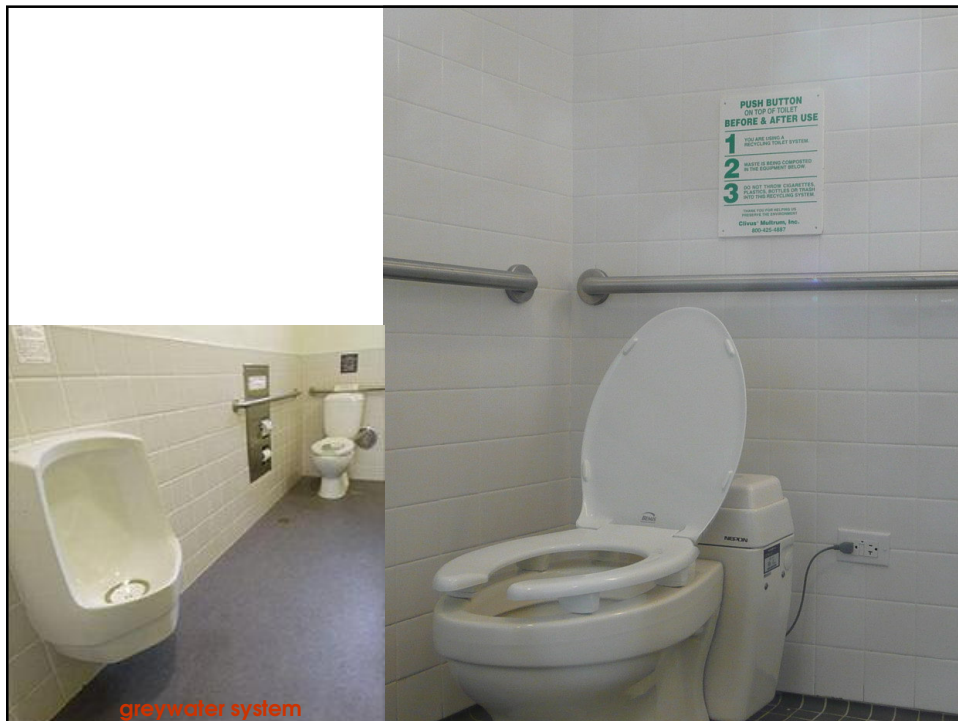
rainwater system



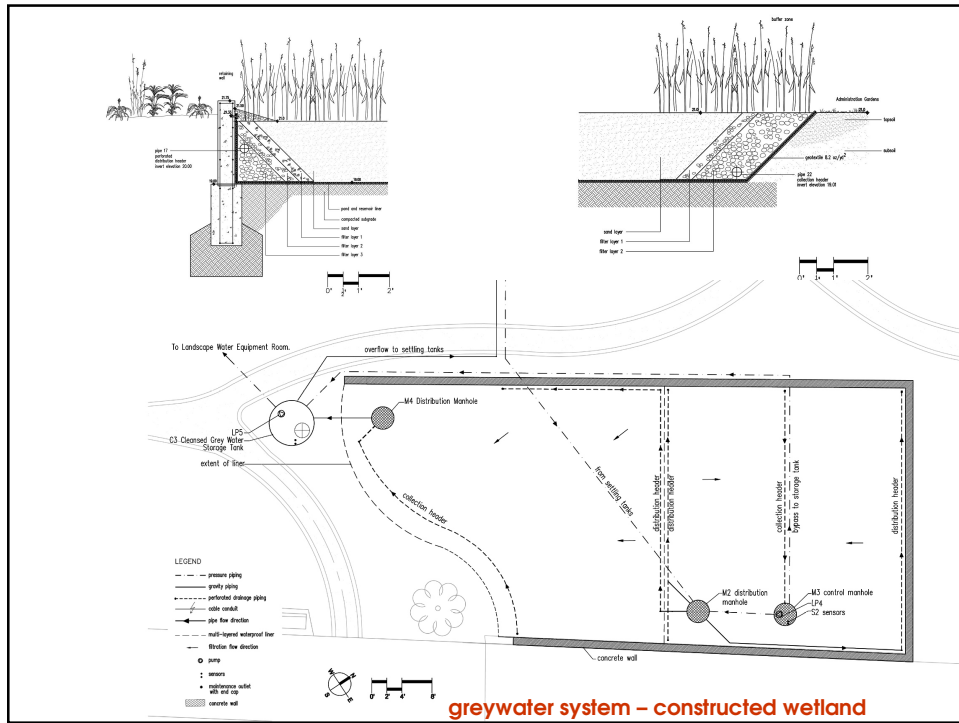
Fixtures/Fittings

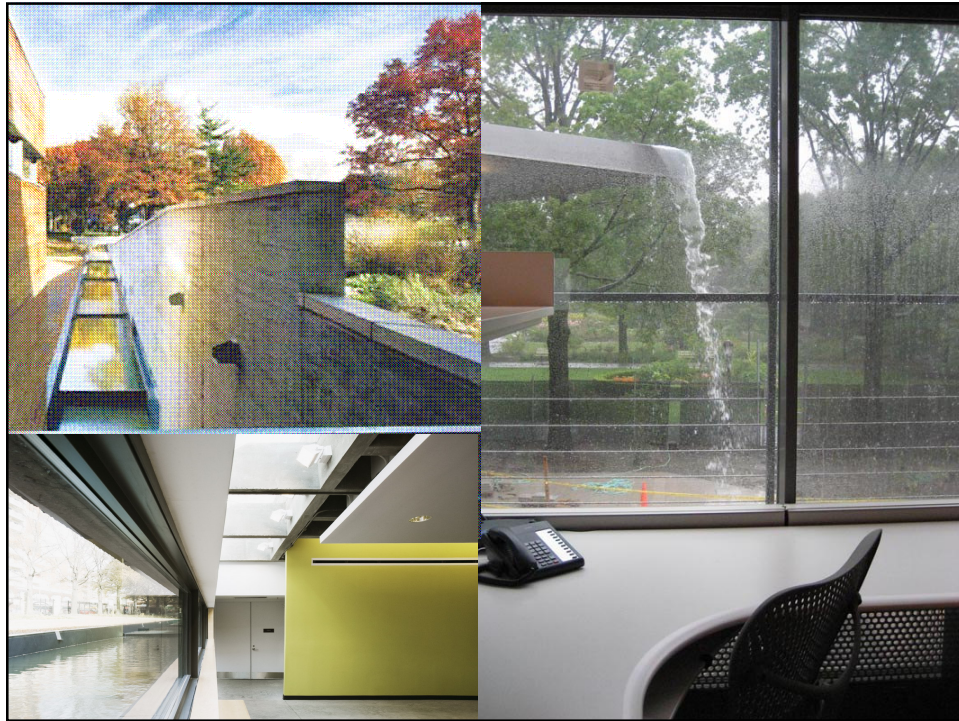
- Low flow (.5 gpm) fittings with electronic sensors

greywater system



greywater system





project leadership:

Owner: Queens Botanical Garden
 Architect: BSK Architects, NYC
 Landscape: Atelier Dreiseitl, Germany
 Conservation Design Forum, IL
 Environ. Viridian Energy & Environmental
 Consultant
 Managers: NYC Dept. of Cultural Affairs
 NYC Dept. Design &
 Construction

All photographs copyrighted and courtesy of Jeff
 Goldberg/ESTO



thank you

RESOURCES

NYC High Performance Building
Guidelines

and

NYC High Performance
Infrastructure Guidelines

[www.home.nyc.gov/html/ddc/
html/ddcgreen/](http://www.home.nyc.gov/html/ddc/html/ddcgreen/)

New Civic Works

www.newcivicworks.com

BKSK Architects

www.bkskarch.com



*"I would feel more optimistic about a
bright future for man if he spent less
time proving that he can outwit
Nature and more time tasting her
sweetness and respecting her
seniority"*

E.B. White, 1977